alberta pork production handbook

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Alberta
AGRICULTURE
Pork Industry Branch

SWINE DIET SUGGESTIONS

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A. Introduction

The steps to follow when formulating swine diets are as follows:

- Identify the class of animals to be fed
- Determine the nutrient allowances for that class
- Determine what ingredients will be used
- Obtain a chemical analyses of these ingredients
- Perform calculations to develop the feed formula

Six classes of pigs are used in Table 1 for establishing the dietary allowances that should be considered when preparing a feed formulation, including the macronutrients required for each class. These nutrient levels may exceed National Research Council (NRC) levels to accommodate animals of different sexes or animals that are genetically superior for growth.

Ideally, diet formulation should be done using analysis results of the feed ingredients on hand. Commercial supplements, soybean meal and canola meal usually come with a guaranteed protein and mineral content. However, the protein and lysine content of cereal grains and peas vary widely and therefore should be analysed for at least protein, so that an accurate diet formulation can be prepared.

Situations may arise when it is not possible to perform an analysis on ingredients before making feed. An example of this is when barley or wheat is purchased from grain elevators or several grain producers and mixed together in one bin. In these cases it is prudent to use average values for these grains. However, this is not advisable for peas because the range of protein variability (16 to 30 per cent) is too wide, and errors in formulation due to the use of average values can be costly because of reduced animal performance.

Canola oil is a common feed ingredient in all-mash diets which are manufactured on farms. About 10 kilograms of oil per tonne is used for dust control. In addition, it contributes nutritionally by increasing the energy content of the feed. It appears that feed intake is increased and pigs gain faster when oil is added to their diets. All diets in this factsheet contain at least 10 kilograms of oil per tonne.

Several formulas using various ingredient combinations are shown for each class of pigs. Diet cost may be compared by pricing out each of these formulas.

B. Average analysis values

Average analysis values of feed ingredients commonly used in Alberta are shown in Table 2. These are taken from NRC Nutrient Requirements of Swine, 1988 and

were used to prepare the feed formulas presented in this factsheet.

Diet formulas are calculated to meet or exceed all dietary requirements of the different classes of pigs according to NRC standards.

C. Prestarter and starter diets

The prestarter and starter diet formulas shown in Table 3 are complex, all of them contain fishmeal, whey powder and medication. Other additives such as probiotics and flavors are optional. It is usually preferable to buy prestarter and starter feeds from a feed manufacturer owing to the number of ingredients needed and the small quantities used. In addition, piglets prefer their feed as crumbles or a small pellet rather than as a mash. Of the two prestarter feeds shown, the high fishmeal and whey diet is preferred because of its better acceptability and performance in younger pigs. The lower fishmeal and whey diet is more suited to piglets that are around six weeks of age. A prestarter formula should be fed until one or two weeks after weaning. Six starter formulas are shown in Table 3. These formulas are suited for pigs older than six weeks of age until they reach a body weight of 25 kilograms. Note that one formula contains peas while two contain canola meal.

D. Grower and finisher diets

Tables 4 and 5 present a number of formulas for grower and finisher feeds. Soybean meal, canola meal and peas are used as the protein sources. The grower diets in Table 4 are designed for pigs from 25 to 50 kilograms body weight. The finisher diets in Table 5 are suitable for pigs over 50 kilograms. The use of one feed throughout the grower and finisher phases is not economical and is not recommended; however, if this must be done, then a grower feed is preferred.

The formulation of grower and finisher diets should take into consideration the genetic potential and sex of the animals. Superior gaining animals require higher levels of essential amino acids in their diet for faster growth.

To accommodate this variation, a range of protein and lysine values are shown in Table 1. Tables 4 and 5 contain formulas to accommodate the ranges shown. In these tables some formulas contain lysine and a lower level of protein. This is appropriate since all other essential amino acids are present in excess and lysine is the one in shortest supply. This procedure actually produces a better balance of essential amino acids and enables more complete utilization of protein. It may also lower the ration cost if lysine is appropriately priced.

Methionine is included in diets that contain peas as the only supplemental protein source. This procedure is considered appropriate for two reasons. First, some analyses of Alberta grown peas show a lower methionine and cystine content than indicated in the NRC tables. This has the potential to make pea diets borderline or deficient in methionine. Second, a few popularly grown varieties may contain higher levels of some protease inhibitors than the smooth yellow cultivars. Presence of these enzyme inhibitors can aggravate a methionine deficiency. Fortunately, peas are high in lysine and therefore lysine is of little concern in pea diets.

Canola meal and peas complement each other well in grower and finisher diets. Because canola meal is high in methionine, supplementation with this amino acid is not necessary when canola meal and peas are used together in feeder pig diets.

E. Sow and boar diets

Table 6 shows 10 diet formulas, five for pregnant sows and five for nurse sows. Boars are fed the same diets as pregnant sows. The formulas contain soybean meal, canola meal and peas as protein sources in various combinations. Some research trials show peas to be an acceptable protein supplement for sows, yet there are others that show a decrease in performance when sows are fed peas. No explanation was given for this loss of performance. In practice, there are several sow herds in Alberta that have been fed peas for over two years without apparent ill effects. Similarly, canola meal can be used in all sow diets as the only protein source. Information on sow feeding is contained in factsheet #440/56-2 - *Feeding Sows and Gilts for Maximum Efficiency*.

F. Vitamin and trace mineral premixes

A mixture of vitamins and trace minerals is called a micropremix.

VITAMINS + TRACE MINERALS = MICROPREMIX

Suggested levels of vitamins and trace minerals for different classes of swine are presented in Table 7. Compared to NRC standards, these levels contain a wide margin of safety and will suffice under all Alberta conditions.

Micropremixes can be made with varying levels of potency. As a general rule, the lower the potency the longer the premix can be stored. In addition, antioxidants other than vitamin E are used as preservatives. In the feed regulations, Agriculture Canada has stipulated that micropremixes must be made for use at five or 10 kilograms per tonne of complete feed: five kilograms for

unmedicated premixes and 10 kilograms for medicated premixes. Sometimes the vitamin and trace mineral micropremixs are made up separately. Keeping them separate slows the deterioration of vitamins. If possible, choline should be omitted from the vitamin premix and added directly to the complete feed because it has an enormous tendency to oxidize other vitamins and destroy them, especially if antioxidants are not used.

The use of micropremixes is not encouraged on farm because some feed mixing equipment on the farm may not be suitable for their use. Also, procurement and proper storage of some vitamin ingredients may prove to be difficult and costly.

G. Macropremixes and supplements

Macropremixes are more commonly used on farms. They contain vitamins, trace minerals, limestone, dicalcium phosphate and salt.

MICROPREMIX + LIMESTONE + DICAL PHOS + SALT = MACROPREMIX

Other phosphorus sources like defluorinated phosphate may also be used if higher calcium and phosphorus levels are needed in the macropremix. The macropremix is also a proper place for other additions like lysine, methionine, etc.

Mixing directions on the label indicate the quantity of macropremix to be used in each type of diet. If the mixing instructions are followed explicitly, the resulting feed will contain adequate amounts of all micro-ingredients. Examples of two macropremixes formulas are shown in Table 8. They are the macropremixes used in Tables 4, 5 and 6.

Commercial supplements

Commercial hog grower and sow supplements are made by adding protein ingredients to a macropremix. Supplements are balanced for amino acids, so that when mixed with grain they produce complete balanced diets. The protein ingredients commonly used are soybean meal, meat and bone meal, fish meal and canola meal. Most of the meat and bone meal produced in Alberta is of very high quality, with digestibility levels as high as 85 per cent.

MACROPREMIX + PROTEIN = SUPPLEMENT

Supplements for feeder pigs differ from those for sows. Interchanging the two supplements should be avoided because this will result in shortages or excesses of some nutrients in the finished feed. Mixing directions on the label indicate the quantity of supplement that should be used with grain to make up one tonne of a feed. This amount normally contains enough minerals, vitamins, salt and protein for one tonne of feed when grain of average protein content is used. If less than the recommended amount of supplement is used because of higher grain protein, the result will be a ration adequate in protein but deficient in minerals, vitamins, salt and probably the amino acid lysine. Conversely, using more supplement than recommended because of low protein grain, can result in a ration that is adequate in protein but excessive in vitamins, minerals and salt. Excess consumption of salt and some trace minerals can cause a decrease in feed intake and an increase in water consumption which leads to soft or watery stools and excessive urine production.

As a rule, variations from recommended supplement usage levels should not exceed 15 per cent either way. Even if protein levels are high in the grain, no less than 85 per cent of the recommended supplement level should be used, otherwise acute shortages of some nutrients may occur. When the grain protein level is low, the best approach is to use the recommended level of supplement then add enough soybean meal or canola meal to achieve the required protein or lysine level.

H. Reference factsheets

Since many of the formulas in this factsheet contain alternative protein ingredients, reference to the following factsheets is useful in understanding the advantages and limitations of these ingredients:

440/65-1 *Minerals for Swine*
440/66-1 *Vitamins for Swine*
440/64-2 *Protein Sources for Swine*
440/64-1 *Canola Meal as a Protein Supplement for Swine*
440/61-3 *Use of Field Peas In Swine Rations*

I. Cautions

Formulas presented in this factsheet should be safe to feed to the class of pigs indicated. All feeds should be palatable when prepared with ingredients containing minimal contamination of weed seeds or mould. These formulas were derived using average analysis values for ingredients; they should not be followed blindly. All grains and field peas should be analysed before use, and when results differ greatly from average values in Table 2, different feed formulas should be made. Assistance in feed formulation is available from feed suppliers, regional swine specialists and the monogastric nutritionist of Alberta Agriculture.

A good quality control program is an essential part of all feed manufacturing activity. Ingredients should be inspected and tested for quality and so should the

complete feeds. To determine mill accuracy, feed samples should be taken as close as possible to the discharge point of the mill. The analysis results of samples so taken can help determine what adjustments to the mill may be required.

Information prepared by:
Sam Jaikaran, M.Sc.
Monogastric Nutritionist
Alberta Agriculture

Table 1. Suggested dietary allowances (As fed basis)

Nutrients		Feed Name and Class of Pigs					
		Prestarter	Starter	Grower	Finisher	Nursing Sows	Pregnant Sows and Boars
		Piglets on Sow	Weaning to 25 kg	25-50 kg	50-100 kg		
Digestible Energy	(kcal/kg)	3400	3400	3200	3200	3200	3000
Protein	(%)	20	18	16-17	14-15	16	14
Lysine	(%)	1.25	1.15	0.75-0.85	0.6-0.7	0.7	0.55
Calcium	(%)	0.9	0.8	0.7	0.6	0.9	0.9
Phosphorus	(%)	0.7	0.65	0.6	0.5	0.7	0.7

Table 2. Average feed ingredient analyses

	D.E.	Protein	Calcium	Phosphorus	Lysine	Methionine + Cystine	Threonine
	kcal/kg	%	%	%	%	%	%
Wheat	3402	13	0.05	0.35	0.40	0.52	0.37
Barley	3120	11.5	0.05	0.35	0.40	0.37	0.36
Oat groats	3755	15.8	0.08	0.43	0.53	0.41	0.44
Soymeal	3680	47.5	0.27	0.65	3.10	1.4	1.86
Canola	2900	36	0.68	1.17	2.15	1.08	1.62
Field peas	3400	23	0.10	0.40	1.65	0.48	0.94
Fishmeal	3845	72	2.20	1.67	5.64	2.82	2.89
Whey	3215	13	0.86	0.76	0.94	0.49	0.89
Lysine	5000	94	0	0	78	0	0
Methionine	3000	58	0	0	0	99	0
Limestone	0	0	38	0	0	0	0
Dicalcium phosphate	0	0	18	21	0	0	0
Salt	0	0	0	0	0	0	0
Canola oil	8130	0	0	0	0	0	0
Grower premix	0	0	19.25	7.22	0	0	0
Sow premix	0	0	20.72	8.65	0	0	0

Table 3. Prestarter and starter pig diets (1000 kg batch)

Ingredients	Prestarter		Starter					
	A	B	C	D	E	F	G	H
Wheat	236	310	466	701	597	682	447	357
Barley					100			
Oat groats	350	350	250				250	250
Soymeal	115	160	105	120	125	90	75	65
Canola						50	50	
Peas								150
Fishmeal	50	25	25	25	25	25	25	25
Whey	200	100	100	100	100	100	100	100
Lysine	2	3	3.75	3.75	3.5	3.5	3.5	3
Limestone	11	13	12	11	11	11	11	11
Dicalcium phosphate	8	11	9	10	10	10	10	10
Salt	3	3	4	4	4	4	4	4
Vit-mineral premix	5	5	5	5	5	5	5	5
Canola oil	20	20	20	20	20	20	20	20
Medication*	+	+	+	+	+	+	+	+
Probiotics	+/-	+/-	+/-	+/-	+/-	+/-	+/-	+/-
Calculated D.E. (kcal/kg)	3548	3553	3510	3426	3399	3392	3477	3498
Calculated protein %	20.3	20.34	18.29	18.23	18.24	18.33	18.39	18.36
Calculated lysine %	1.25	1.25	1.15	1.15	1.15	1.15	1.15	1.15
Calculated calcium %	0.91	0.92	0.83	0.81	0.81	0.83	0.84	0.81
Calculated phos %	0.71	0.71	0.65	0.65	0.65	0.68	0.7	0.66

*Refer to factsheet no. 440/67-1 *Feed Additives for Swine*

Table 4. Grower diets for feeders 25 to 50 kg body weight (1000 kg batch)

Ingredients	A	B	C	D	E	F	G	H	I	J
Wheat	250	250	250	250	250	250	250	250	250	250
Barley	535	572	498	542	282	377	383	428	588	607
Soymeal	173	136	105	83					118	100
Canola			105	83			125	110		
Peas					425	330	200	170		
Lysine HCl									2	1.5
Methionine					1	1				
Grower macro premix	32	32	32	32	32	32	32	32	32	32
Canola oil	10	10	10	10	10	10	10	10	10	10
Calculated D.E. (kcal/kg)	3238	3217	3176	3169	3260	3233	3169	3164	3211	3200
Calculated protein %	17.62	16.29	17.74	16.41	16.33	15.23	16.75	16.04	15.81	15.12
Calculated lysine %	0.85	0.75	0.85	0.75	0.91	0.79	0.85	0.79	0.85	0.77
Calculated calcium %	0.70	0.69	0.75	0.73	0.69	0.68	0.75	0.74	0.69	0.69
Calculated phos %	0.62	0.61	0.68	0.66	0.59	0.58	0.68	0.67	0.60	0.60

Table 5. Finisher diets for feeders 50 to 110 kg bodyweight (1000 kg batch)

Ingredients	A	B	C	D	E	F	G	H	I	J	K
Wheat	250	250	250	250	250	250	250	250	250	250	250
Barley	594	632	568	612	416	512	492	552	621	601	562
Soymeal	118	80	72	50					90	55	
Canola			72	50			85	60		55	150
Peas					295	200	135	100			
Lysine HCl									1	1	
Methionine					0.75	0.5					
Grower macro premix	28	28	28	28	28	28	28	28	28	28	28
Canola oil	10	10	10	10	10	10	10	10	10	10	10
Calculated D.E. (kcal/kg)	3219	3198	3178	3170	3236	3209	3172	3168	3206	3174	3120
Calculated protein %	15.69	14.32	15.79	14.16	14.87	13.76	15.07	14.06	14.76	14.85	15.11
Calculated lysine %	0.70	0.60	0.70	0.60	0.75	0.63	0.70	0.61	0.70	0.70	0.65
Calculated calcium %	0.61	0.60	0.65	0.63	0.60	0.60	0.65	0.63	0.61	0.63	0.68
Calculated phos %	0.57	0.56	0.62	0.59	0.55	0.55	0.62	0.59	0.57	0.60	0.66

Table 6. Pregnant sow, nursing sow and boar diets (1000 kg batch)

Ingredients	— Pregnant Sow and Boar Diets —					——— Nursing Sow Diets ———				
	A	B	C	D	E	F	G	H	I	J
Wheat						400	400	400	400	300
Barley	868	848	818	798	768	413	383	348	303	373
Soymeal	80	50				120	75			
Canola		50	130	60			75	185	80	
Peas				90	180				150	260
Sow macro premix	42	42	42	42	42	42	42	42	42	42
Canola oil	10	10	10	10	10	25	25	25	25	25
Calculated D.E. (kcal/kg)	3084	3056	3010	3051	3089	3294	3253	3186	3251	3273
Calculated protein %	13.78	13.93	14.09	13.41	12.97	15.65	15.87	15.86	15.01	14.17
Calculated lysine %	0.60	0.60	0.60	0.60	0.60	0.70	0.70	0.70	0.70	0.70
Calculated calcium %	0.94	0.96	1.00	0.96	0.93	0.94	0.98	1.03	0.97	0.93
Calculated phos %	0.72	0.75	0.80	0.75	0.70	0.73	0.77	0.84	0.76	0.70

Table 7. Suggested vitamins and trace mineral supplementation per kg of swine diets

Nutrients		Prestarter/ Starter	Grower/ Finisher	Gestation/ Lactation
Vitamin A	(IU)	7500	5000	7500
Vitamin D_3	(IU)	500	500	1000
Vitamin E	(IU)	40	40	60
Riboflavin	(mg)	12	12	12
Niacin	(mg)	40	30	30
Pantothenic acid	(mg)	25	20	20
Vitamin B_{12}	(mcg)	30	25	25
Choline	(mg)	600	300	600
Folic acid	(mg)	1.6	0	4.5
Biotin	(mcg)	250	0	250
Zinc	(mg)	120	100	120
Copper	(mg)	125	20	20
Manganese	(mg)	20	12	12
Iron	(mg)	150	150	150
Selenium	(mg)	0.3	0.3	0.3
Iodine	(mg)	0.2	0.2	0.2

Table 8. Macropremixes for growers and sows (1000 kg batch)

Ingredients		Grower/Finisher Premix	Sow and Boar Premix
Limestone		344	350
Dicalcium phosphate		344	412
Grower Vit-TM Premix *		156	—
Sow Vit-TM Premix *		—	119
White Salt		156	119
Calculated calcium	%	19.25	20.72
Calculated phosphorus	%	7.22	8.65

*For use at 5 kg/tonne of complete feed

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